



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

Address: COMMISSIONER FOR PATENTS

P.O. Box 1450

Alexandria, Virginia 22313-1450

www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,852	08/18/2003	Qinbai Fan	GTI-1542	4043
33058	7590	05/23/2008		
MARK E. FEJER			EXAMINER	
GAS TECHNOLOGY INSTITUTE			CHU, HELEN OK	
1700 SOUTH MOUNT PROSPECT ROAD				
DES PLAINES, IL 60018			ART UNIT	PAPER NUMBER
			1795	
			MAIL DATE	DELIVERY MODE
			05/23/2008	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.



UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents  
United States Patent and Trademark Office  
P.O. Box 1450  
Alexandria, VA 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/642,852  
Filing Date: August 18, 2003  
Appellant(s): FAN, QINBAI

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed February 29, 2008 appealing from the Office action mailed December 31, 2007.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

2004/0110051	Srinivas	6-2004
2002/0183470	Tripathy et al.	12-2002

Sigma-Aldrich, "Conducting Polymers"

[http://www.sigmaaldrich.com/aldrich/bulletin/al\\_ms\\_app\\_catalog\\_fuelcell.pdf](http://www.sigmaaldrich.com/aldrich/bulletin/al_ms_app_catalog_fuelcell.pdf), pp. 153

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-14 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Srinivas (US Publication 2004/0110051 A1) in view of Tripathy et al. (US Publication 2002/0183470 A1) as evidenced by Sigma Aldrich (Conducting Polymers).

In regard to claims 1-11, 40, the Srinivas reference discloses a fuel cell with an anode catalyst layer comprising a proton conductive material made of sulfonic acid (Paragraph 22). The Srinivas reference discloses a grafted sulfonated polyaniline and a polypyrrole ionomer that is electrically conductive and dispersed throughout a carbon support in fuel cell catalysts (Paragraph 41 and Paragraph 30), however, the Srinivas reference does not disclose a material comprising lignin. The Tripathy et al. reference discloses the use of another form of polyaniline, or more specifically, polyaniline-lignin sulfonate complexes (Paragraph 25) which are used as proton conducting polymers (polyelectrolyte) disposed on electrically charged substrates (Paragraph 11) in a variety of electrochemical devices. The polyaniline-lignin sulfonated complex is known for use as a proton conducting material (Example 4). The Tripathy reference further discloses these polyaniline-lignin sulfonate complexes are water soluble virtually eliminating the need for toxic reagents and solvents, and thus creating an environmentally friendly synthesis (Paragraph 14), therefore it would have been obvious to one of ordinary skill to place proton conductive polymers such as polyaniline-lignin sulfonate complexes

disclosed by Tripathy into electrochemical device such as the fuel cell; the fuel cell utilizes a sulfonated polyaniline catalyst layer as disclosed by Srinivas in order to create a light weight electrochemical cell without environmental hazards. It is well known in the art that a PEM fuel cell is an electrochemical device having an anode, a cathode and a proton exchange membrane electrolyte. One of skill would have been motivated to use the polyaniline-lignin sulfonate complex of Tripathy for the grafted sulfonated polyaniline polyelectrolyte of Srinivas because Tripathy teaches such complexes are known for use as proton conductive materials disposed on an electrically conductive substrate and are environmentally friendly.

As further evidence provided by Sigma Aldrich that polyaniline grafted to lignin with ligno-sulfonic acid dopants (Column 2, Paragraph following "Polyaniline (emerald salt) long chain, grafted to lignin) are inherently conductive polymers and can be used as fuel cell and battery conducting materials (Right Tab).

In regards to claim 12, the Srinivas reference discloses a proton exchange membrane electrolyte with a thickness of 50-175  $\mu\text{m}$  (Paragraph 17).

In regards to claim 13, the Srinivas reference discloses a catalyst layer that comprises platinum from Johnson Matthey (Paragraph 28) with a combination of ruthenium (Paragraph 146) and has a loading 0.15  $\text{mg}/\text{cm}^2$  (Paragraph 163).

In regards to claim 14, the Srinivas reference discloses the sulfonated group per monomer unit on the polymer ranges from 0.2- 2.9 (Paragraph 140).

Please note that in citing Sigma-Aldrich as evidence of inherency, the discussion

found in MPEP 2124, Exception to the Rule That the Critical Reference Date Must Precede the Filing Date applies. That is, in certain circumstances, references cited to show a universal fact need not be available as prior art before applicant's filing date. In re Wilson, 31 F.2d 266, 135 USPQ 442 (CCPA 1962). Such facts include the characteristics and properties of a material or a scientific truism.

#### **(10) Response to Argument**

1. The Applicant argues, *"the Srinivas publication neither teaches nor suggests an anode catalyst comprising lignin as claimed by Appellant, a fact acknowledged by the Examiner"* and *"nowhere does the Tripathy et al. publication teach the use of electrically conductive polymers comprising lignin in fuel cells,"* and *"Nowhere does the Tripathy et al. publication teach or suggest the use of a lignosulfonate-Pani complex as part of an anode catalyst layer which is both proton and electron conductive employed in a fuel cell as claimed by Appellant."* However, if Srinivas publication had disclose an anode catalyst comprising lignin and the Tripathy et al. reference teaches fuel cells, these two prior art would have been used in a rejection under 35 U.S.C 102 (e) and (b), respectively. This is not the case, the rejection was rejected under 35 U.S.C 103(a) as unpatentable over Srinivas publication in view of Tripathy et al. The Srinivas reference discloses a methanol fuel cell (Paragraph 12) with a proton conductive polymer membrane electrolyte sandwiched between electrocatalyst (a cathode and an anode) (Paragraph 6), in which the Applicants admits that these elements are prior art in claims 1 and 40 preceding with the recitation "improvements." The Srinivas reference teaches a general teaching of sulfonated polyaniline catalyst support layer (Paragraph

Art Unit: 1795

41). The Srinivas reference does not disclose the conductive polymer with lignin. The Tripathy et al. reference teaches a particulate form of sulfonated polyaniline i.e. a lignosulfonated-Pani (polyaniline) complex (Example 4, Paragraph 25) to be a polyelectrolyte (Paragraph 69), these polyelectrolytes are suitable as anionic polymers (Paragraph 39). These polymers are conductive and may be used in a variety of electronic devices (electronic devices such as a fuel cell, Paragraph 3). The Tripathy et al. reference also provides motivation to utilize these complexes, please refer to the rejection disclosed above. It is obvious to use the materials for the same purposes (i.e. as conductive polymer for catalyst supports) because the anodes of a fuel cell are known to the art to require conducting materials. As further evidence by Sigma-Aldrich reference further discloses polyaniline grafted to lignin and contains ligno-sulfonic acid as dopants are conductive polymers (Column 2, Paragraph following "Polyaniline (emerald salt long chain), grafted to lignin"). The reference also states that these polymers can be used as fuel cell or battery materials (Right Tab).

2. Applicant argues, "That is, according to the Examiner, because batteries and PEM fuel cells are both electrochemical devices having anodes, cathodes and proton exchange membrane electrolytes, batteries and PEM fuel cells are functionally equivalent. Thus, the Examiner argues that teachings with respect to batteries (as set forth in the Tripathy et al. publication) are applicable to PEM fuel cells and, thus, the invention claimed by Appellant involves nothing more than ordinary skill in the art. Appellant respectfully disagrees...Appellant respectfully urges that fuel cells and batteries are not functional equivalents as asserted by the Examiner." However, the as

addressed by the Examiner under "Response to Arguments" in Final Office Action dated 12/31/2007, Item F; The Srinivas teaches a broad compound of sulfonated polyanilines for catalyst support in a fuel cell. The Tripathy et al. reference discloses a particular form of sulfonated polyaniline to be sulfonated polyaniline grafted lignin in which are polyelectrolytes used conductive material used in electrochemical devices. The anodes of both fuel cell and battery require conducting polymers and therefore it would have been obvious to one of ordinary skill in the art to interchange the two materials for the same purposes i.e. the materials for conductivity is found on an anode of the fuel cell and the anode of a battery.

3. Applicant argues, *"the Examiner is asserting that any material having some compositional component of known fuel cells which is electrically conductive is suitable for use in a fuel cell, including direct methanol fuel cells as claimed by Appellant, and such materials provide the improvements exhibited by the fuel cells claimed in the subject application. That is, based upon the motivation for combining the teachings of the Srinivas and Tripathy et al. publications proffered by the Examiner, any sulfonated polymer that is electrically conductive, regardless of any additional elements or compounds which form the polymer, is suitable for use in the anode catalyst of a fuel cell. Appellant respectfully disagrees."* However, as evidence by Sigma Aldrich, the conducting polymers such polyaniline grafted lignin containing ligno-sulfonic acid are inherently conductive and can be used in all fuel cell and battery applications (emphasis added). The Srinivas reference teaches all of the claimed elements in addition to teachings of general compounds such as sulfonated polyaniline catalyst support layer.



Art Unit: 1795

The Tripathy et al. reference teaches the a particular form of sulfonated polyaniline (i.e. compound of ligno-sulfonated polyaniline complexes) are polyelectrolytes that are anionic, these conductive polyaromatic polymers can be used in electronic devices with motivation provided. These ligno-sulfonated polyaniline compounds are similar to those taught in the Sigma Aldrich reference. It is taught by the Sigma Aldrich that these compounds can be employed in fuel cells and batteries.

4.     Applicant argues, " *Regarding Claim 40, which claims improvements to a direct methanol fuel cell, the Examiner argues that the type of fuel (i.e. methanol) does not limit the structure of the fuel cell, as all fuel cells have an anode, a cathode, and electrolytes. Appellant respectfully disagrees. Appellant respectfully urges that, while it may be true that all fuel cells have an anode, a cathode and an electrolyte, part of the structure of the fuel cell is the materials used to make the fuel cell components, which, in turn, is dictated by the type of fuel cell as well as the fuel employed in the fuel cell. For example, the materials used to make the components of a proton exchange membrane fuel cell, which typically operates at a temperature of less than about 100°C, would not be suitable for use in a solid oxide fuel cell which operates at temperatures typically greater than about 700°C.*- 5.     *Similarly, the materials used to make the fuel cell components are dictated in part by the fuel used to power the fuel cell. For example, fuel cells typically run on hydrogen in which hydrogen gas is fed to the anode electrode. In some cases, the hydrogen is produced external to the fuel cell and fed directly to the anode electrode of the fuel cell. In other cases, a fuel gas, such as methane, may be introduced into the fuel cell where*

Art Unit: 1795

*it is reformed to produce hydrogen and CO<sub>2</sub> which methanol, is fed directly to the anode electrode of the fuel cell (i.e. direct methanol fuel cells) where it undergoes oxidation at the anode catalyst surface to produce CO<sub>2</sub>, protons, and electrons. One of the problems with direct methanol fuel cells as discussed at Page 10, lines 1-16 of the specification of the subject application is the tendency of the methanol molecules also to pass through the electrolyte membrane and react with oxygen at the cathode side, a problem which does not exist with hydrogen fueled fuel cells. Thus, direct methanol fuel cells require fuel cell components comprising materials, such as the materials claimed by Appellant, to inhibit or prevent this methanol crossover. Such materials are not required by hydrogen-fueled fuel cells. Accordingly, Appellant respectfully urges, contrary to the assertion by the Examiner, that the structure of a fuel cell, specifically the materials used to produce the fuel cell components, is affected by the type of fuel used to fuel the fuel cell."* However, as evidence by Sigma Aldrich, the conducting polymers such polyaniline grafted lignin containing ligno-sulfonic acid are inherently conductive and can be used in all fuel cell and battery applications (emphasis added). The Srinivas reference teaches all of the claimed elements including a methanol feed fuel cell, in addition to teachings of general compounds such as sulfonated polyaniline catalyst support layer. The Tripathy et al. reference teaches the a particular form of sulfonated polyaniline (i.e compound of ligno-sulfonated polyaniline complexes) are polyelectrolytes that are anionic, these conductive polyaromatic polymers can be used in electronic devices with motivation provided. These ligno-sulfonated polyaniline compounds are similar to the compound taught in the Sigma Aldrich reference. It is also

Art Unit: 1795

taught by the Sigma Aldrich that these compounds can be employed in fuel cells and batteries.

6. The Applicant argues, " *The Examiner argues that this limitation is met by the teachings of paragraph [0136] of the Srinivas publication, which discloses the sulfonated group per monomer unit on the polymer ranges from 0.2-2.9. Appellant respectfully urges that nothing in the recitation of the Srinivas publication cited by the Examiner teaches a fuel cell having an anode catalyst layer in which the electron conductive material comprises in the range of about 5% to about 20% as claimed by Appellant*" However, Paragraph 140 states that the sulfonated conducting polymer can be greater than 0% to 100% by weight, specifically stated, 5, 7, 10, 12, 15, 17, and 20% by weight.

7. The Applicant argues, " *The reference is Page 153 from an internet catalog of Sigma-Aldrich Company (hereinafter "the Sigma-Aldrich reference"). Appellant respectfully urges that, not only is the reference not a proper prior art reference, but also it neither teaches nor suggests the use of polyaniline-lignin sulfonate complexes in a fuel cell as argued by the Examiner.*

*As previously stated, the newly cited Sigma-Aldrich reference cited by the Examiner in support of the rejection of the subject application is an undated reference taken from the Internet catalog of Sigma-Aldrich Company. The Examiner argues that the undated reference is proper under MPEP § 2124 Exception to the Rule That the Critical Reference Date Must Precede the Filing Date. The Examiner states*

*"That is, in certain circumstances, references cited to show a universal fact need not be available as prior art before applicant's filing date. In re Wilson, 311 F.2d 266, 135 USPQ 442 (CCPA 1962). Such facts include the characteristics and properties of a material or a scientific truism."*

*Thus, the Examiner argues that the reference is suitable for showing a "universal fact," namely that polyaniline has the characteristic and property of being conductive and that it can be used in a fuel cell. Appellant respectfully urges that neither the existence of a material composition nor the usages of the material composition, both of which are at issue in the subject application, are or can be considered to be universal facts. In addition, the fact that a known material may have certain known characteristics and properties does not mean that uses of the material are universal facts. After all, new (and patentable) applications of known materials are created all the time. Accordingly, Appellant respectfully urges that the Sigma-Aldrich reference is not a reference which falls within the exception of MPEP § 2124 and, thus, cannot be cited in support of the rejection of the subject application"* However, these are assertions of which the Applicants did not provide further evidence. The Sigma-Aldrich reference discloses a property of a material such as polyaniline, grafted lignin with ligno-sulfonic acid is conductive, an inherent property or a universal fact. Another universal fact or an inherent property is that fuel cell and battery anodes both require conductive materials. These properties of polyaniline, grafted lignin with ligno-sulfonic acid makes the compound capable of being used in fuel cell and batteries (emphasis added). The Srinivas teaches a broad compound of sulfonated polyanilines for catalyst support in a fuel cell. The Tripathy et al. reference discloses a particular form of sulfonated polyaniline to be sulfonated polyaniline grafted lignin in which are polyelectrolytes used conductive material used in electrochemical devices. The anodes of both fuel cell and battery require conducting polymers and therefore it would have been obvious to one of

ordinary skill in the art to interchange the two materials for the same purposes. Though the Sigma-Aldrich reference is undated, please note that in citing Sigma Aldrich as evidence of inherency, the discussion found in MPEP 2124, Exception to the Rule That the Critical Reference Date Must Precede the Filing Date applies. That is, in certain circumstances, references cited to show a universal fact need not be available as prior art before applicant's filing date. In re Wilson, 31 F.2d 266, 135 USPQ 442 (CCPA 1962). Such facts include the characteristics and properties of a material or a scientific truism.

The Applicants argue, "In addition, MPEP § 2128 also states under the section entitled "Date of Availability" that

*"Prior art disclosures on the Internet or on an online database are considered to be publicly available as of the date the item was publicly posted. If the publication does not include a publication date (or retrieval date), it cannot be relied upon as prior art under 35 U.S.C. 102(a) or (b)."*

Accordingly, Appellant respectfully urges that the Sigma-Aldrich reference clearly is an undated Internet disclosure and, thus, in accordance with this section of the MPEP, is not a proper reference for rejection of the subject application." However, please note that in citing Sigma Aldrich as evidence of inherency, the discussion found in MPEP 2124, Exception to the Rule That the Critical Reference Date Must Precede the Filing Date applies. That is, in certain circumstances, references cited to show a universal fact need not be available as prior art before applicant's filing date. In re Wilson, 31 F.2d 266, 135 USPQ 442 (CCPA 1962). Such facts include the characteristics and properties of a material or a scientific truism.

The Applicants argue, "Even if the Sigma-Aldrich reference were a proper reference, Appellant respectfully urges that the Sigma-Aldrich reference clearly does not teach or suggest the use of polyaniline-lignin sulfonate complexes in the anode catalyst layer of a fuel cell as in the invention claimed by Appellant. In particular, Appellant respectfully urges that disposition of the reference page in a section of a catalog labeled "Fuel Cell/Battery Materials" does not mean that the materials listed therein are suitable for both fuel cell and battery applications. In addition, the Sigma-Aldrich reference explicitly states that polyaniline (emeraldine salt) is "an additive in polymer blends and liquid dispersions for electromagnetic shielding, charge dissipation, electrodes, batteries and sensors, "a list from which fuel cells is notably absent. Nowhere does the Sigma-Aldrich reference explicitly teach or suggest suitability of the material for use in fuel cells." Again, these are all assertions of which the Applicant did not provide additional evidence in support of their arguments. The Sigma-Aldrich reference states that polyaniline, grafted lignin with ligno-sulfonic acid is conductive, materials in which are suitable for either a battery and a fuel cell. It is inherent that an anode of either a fuel cell or a battery requires conductive polymer materials. The Applicants cited "polyaniline an additive in polymer blends and liquid dispersions for electromagnetic shielding, charge dissipation, electrodes, batteries and sensors, a list which fuel cells are absent " however please refer to the to the bottom right component in which states "Polyaniline (emerald salt) long chain, grafted to lignin" which is the correct compound that the Examiner is citing. Assuming arguendo that the Applicant is citing the correct polymer, the polyaniline does cite "electrodes" which are applicable to electrodes of the fuel cells.

Art Unit: 1795

**(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Helen Chu

/Helen O Chu/

Examiner, Art Unit 1795

Conferees:

Patrick Ryan

/PATRICK RYAN/

Supervisory Patent Examiner, Art Unit 1795

William Krynski

/William Krynski/

Quality Assurance Specialist, TC 1700